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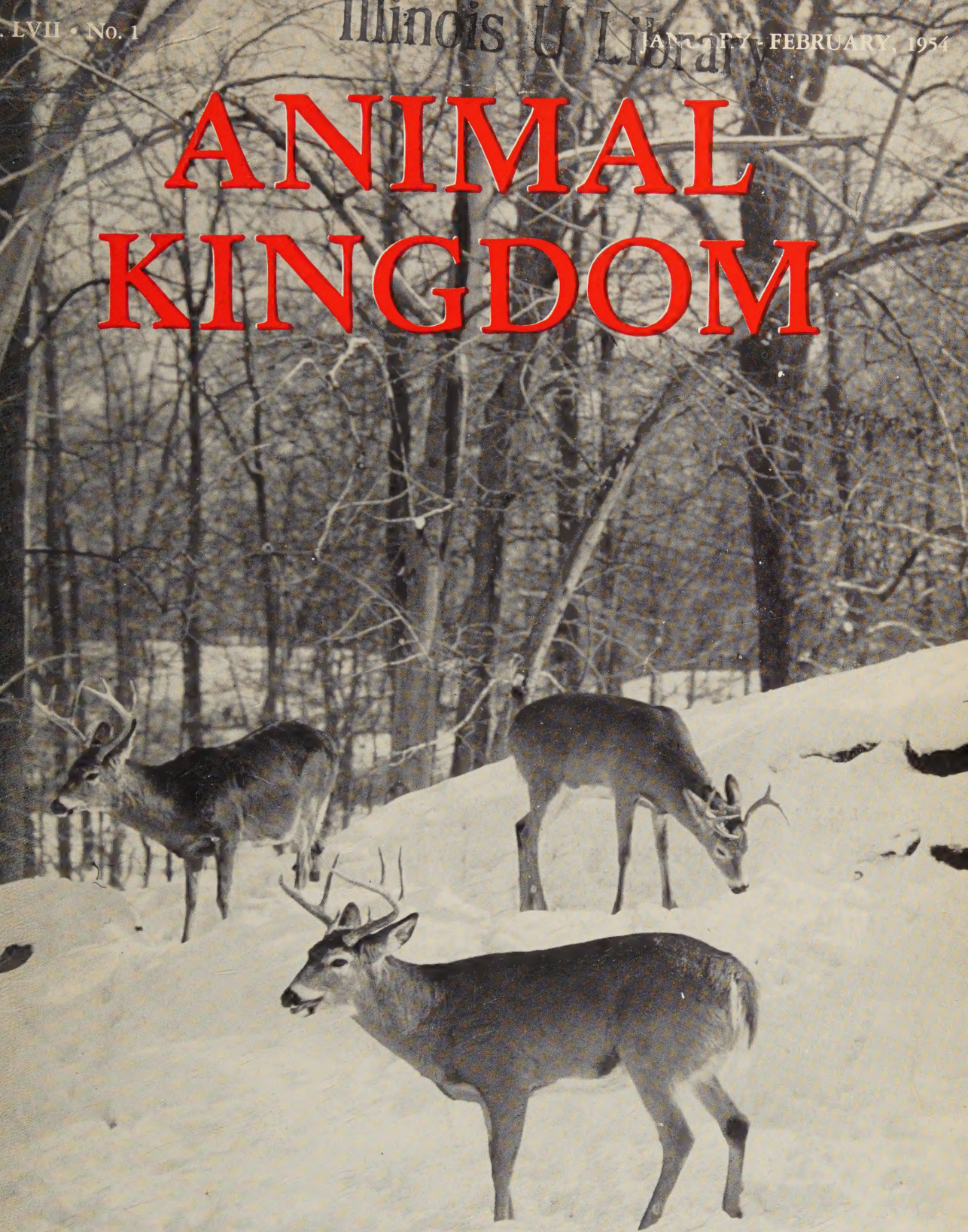
ANIMAL KINGDOM



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ANIMAL KINGDOM

Bulletin of the New York Zoological Society

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The Realities of Progress

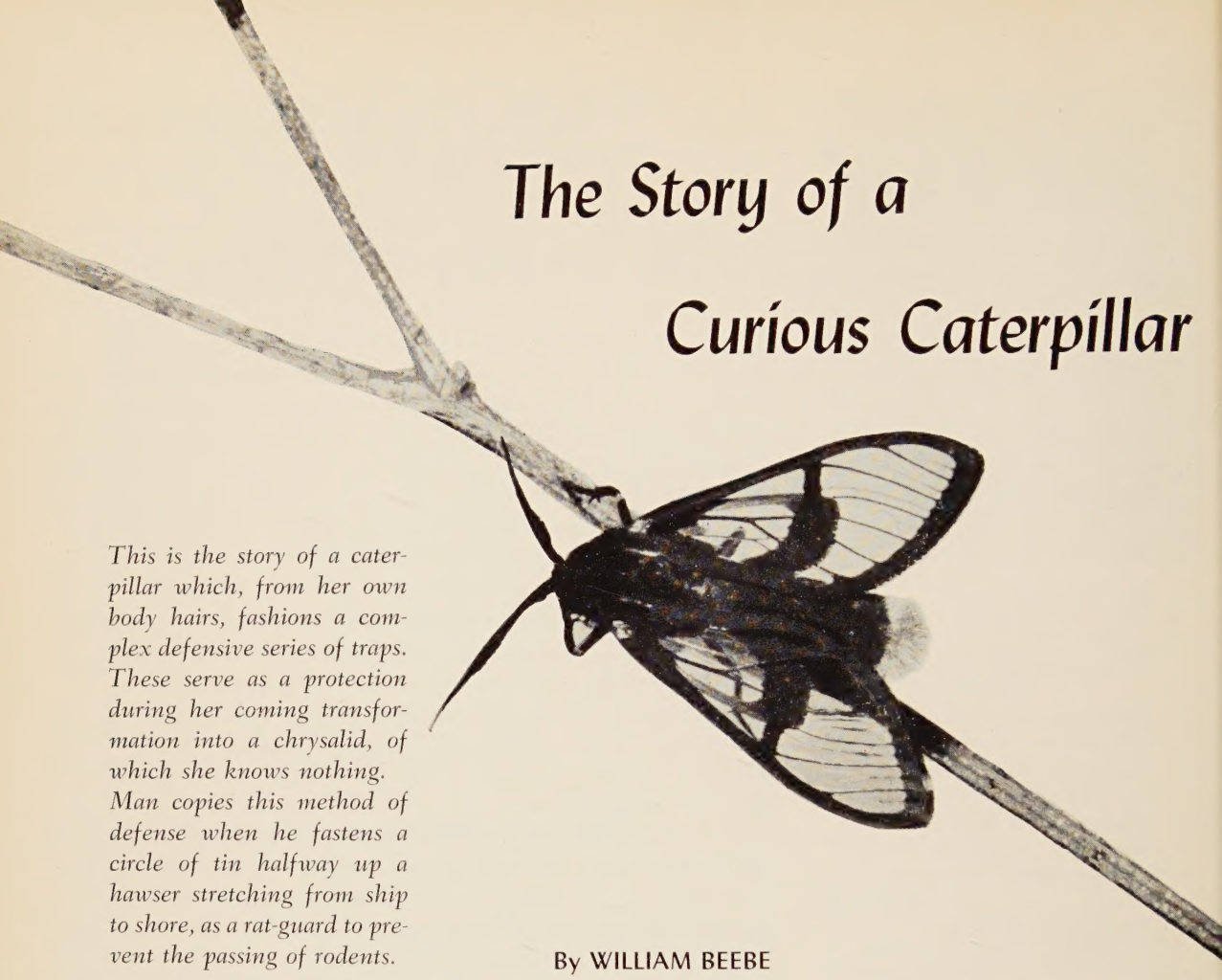
As we leave one year behind and begin another the extraordinary variety of activities of our institution strikes one anew. That our work contains many contrasts is not actually surprising because it is dedicated to the animal kingdom whose countless aspects of form and meaning are virtually beyond human comprehension. It so happens that the Zoo itself, with its animals of widely different kinds, provides a symbol of the numerous facets of our fields of interest. For instance, the largest animal in the Zoo weighs more than 3 tons, the smallest less than a penny. Yet this symbol is purely a physical one and therefore too limited because our purposes extend into seeking further knowledge regarding the "ways of life" of animals, into varied programs of scientific research, into wildlife protection and the conservation of the earth's living resources, and, finally, into the crowning purpose of all – providing recreation and education to the public.

Each year seems to bring its own particular, sometimes exciting, developments. 1953 was good to us. Plans for the building of the first stage of the new Aquarium were completed through the generous help of our Trustees and of the City. The site of the Tropical Research Station in Trinidad was deeded to the Society by its faithful and gifted Director Emeritus. Effective research work continued apace. The Zoo was further modernized. An outstanding project in wildlife protection, resulting in the publication of the book, WILDLIFE IN ALASKA, was completed. Receipts of membership dues reached an all time high. Educational activities were somewhat increased. True, Penelope, the tantalizing platypus, disappointed a waiting world, but perhaps her "shining hour" is yet to come. All in all it was a good year.

What of 1954 and on? So much, so very much, will depend upon the support given the Society by its members and friends. It is one thing merely to maintain the status quo and continue in reasonable financial health. It is quite another to grow in accomplishment, and to meet, with vitality, the unfolding opportunities that lie ahead. Our organization is privileged to work in a unique field of interest and service. Only with the faith of our members and friends, made tangible by generous financial aid, can our institution do justice to its future.

Fairfield Osborn

The Story of a Curious Caterpillar



This is the story of a caterpillar which, from her own body hairs, fashions a complex defensive series of traps. These serve as a protection during her coming transformation into a chrysalid, of which she knows nothing. Man copies this method of defense when he fastens a circle of tin halfway up a hawser stretching from ship to shore, as a rat-guard to prevent the passing of rodents.

By WILLIAM BEEBE

THE FULL LIFE CYCLE, on the earth, of a moth or a butterfly, may be encompassed in four words — egg, caterpillar, pupa and adult. To be technically exact, this sequence is not precisely a circle, but rather a very flat spiral, for from egg to egg there must be some infinitesimal change, plus or minus. This variation may be ultra-microscopic, it may be lost in the next reshuffling of genes, but it must exist, for not otherwise can we have evolution.

The cycle is far from being a smooth passage through time and space, for in its course there are vital crises. The methods of meeting and overcoming these crises occupy considerable of our attention in our behavior studies at the Department of Tropical Research station at Simla in Trinidad. To explain their origin and development would advance us several steps on the road to deeper knowledge of the inner workings of evolution.

The mature female moth or butterfly, to justify her existence in the race for life and to prevent the extinction of her kind, must overcome three major hurdles. She must avoid danger (witness honorable wing scars left by the futile snap of a bird's beak); she must obtain food (requiring a preknowledge, somehow handed on through egg and caterpillar, of correct color or right scent, leading to the hidden nectary); a mate is prerequisite to continual existence (to be perceived amid the surrounding world of life in field and forest, to be recognized and submitted to).

Finally, by some inexplicable prophetic instinct (whatever that means) the parent moth must anticipate the correct sustenance of her future offspring; the egg must be deposited on the par-

ticular and suitable leaf or blade. Egg after egg may be laid with only this dietetic safeguard, or an exceedingly complex mechanism may be provided for the future protection of the young larva.[1]

The actual hatching of the average caterpillar presents no immediate physical hazards, for, having spent a few days within a beautifully fluted egg, on emerging the larva proceeds with the greatest possible speed to reverse the process and place the egg-shell within its own, less artistic self. Following this, it finds vegetative nourishment ready at hand for its stout jaws.

The caterpillar is not bothered with problems of sex, for while already pre-ordained to ultimate male or femaleness, yet in its short, larval phase of life it has all the advantages, together with the unenviable futility, of temporary sexlessness.

On the other hand, escape from danger is an ever-present necessity, and daily and hourly existence is plagued with the boogies of "early birds" and still more sinister parasites. Its ganglionic instincts impel cryptic poses and display of pigments – inclining to gray lichen hues if it be readily edible, or flaming scarlet and yellow if life fluids are adulterated with acidity. Or it may simulate a twig or develop a brave attempt to look like nothing. It may even climb up its own pellets to escape inimical appraisal.[2]

All these are commonplace facts, but they are also commonplace miracles. At this moment, upon our earth, metamorphoses are taking place in something like a million of species, and billions of individual insects. So it is not unwise to have them recalled, now and then, to our consciousness.

The supreme crisis in the life of a caterpillar comes, as with ourselves, at the apparent end of its active life. It must prepare to become a mummy. Resurrection, to a caterpillar, is such a certainty that it does not have to have faith; in fact, it has nothing to have faith with. Its actions speak for themselves and in these preparations instinct never more effectively masquerades as intelligence. In pseudo-ingenuity the child caterpillar equals the performances of his parent. One of these cases has been observed, and is the subject of this paper.

[1] Miracle of the Palisade Bell Moth. *Animal Kingdom*, June, 1948, pp. 76-79.
[2] Life History of *Colobura*. *Zoologica*, 37:16, pp. 199-202.

On the tenth of February a caterpillar was brought into the laboratory at Simla. It was a very small creature, about one-third of an inch long, undistinguished in grass green and black. The chief thing in its favor was that we knew its food plant. It was feasting upon a blade of grass, or more definitely, the leaf of a black-and-white Trinidad sedge, and this plant grew in abundance in damp places on the forest floor.

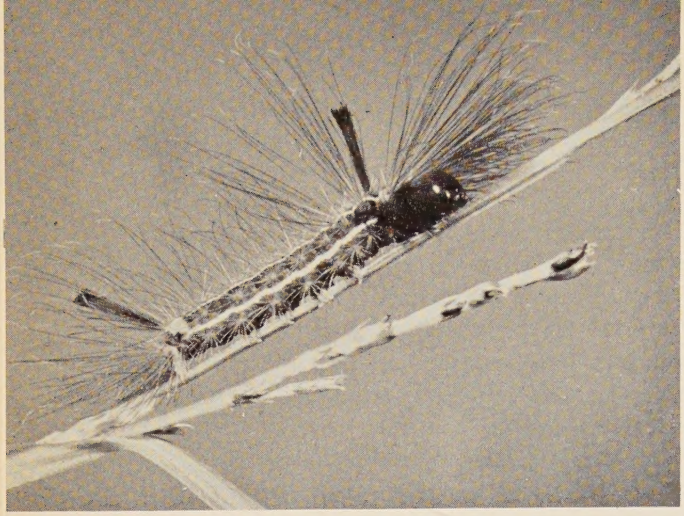
Human eye-sight being the poor thing it is, we focussed the larva into a higher bracket of visibility, revealing the forbidding aspect of the sedge leaf. Considered as baby food for a small caterpillar it resembled rather a double-edged cross-cut saw with serried rows of sharp, silicious spines. Yet the little being was tucking it away with ravenous speed.

For exactly one month, the caterpillar ceased eating only for sleep, whatever such open-eyed periods of quiescence may mean. As it ate, it grew, and five times it shed its skin, slipping out of a tangled mass of hairs and spines. Lacking broken glass, the larva turned around and devoured every bit of the ill-favored fodder. A Frenchman would have defined its digestive powers as *formidable*.

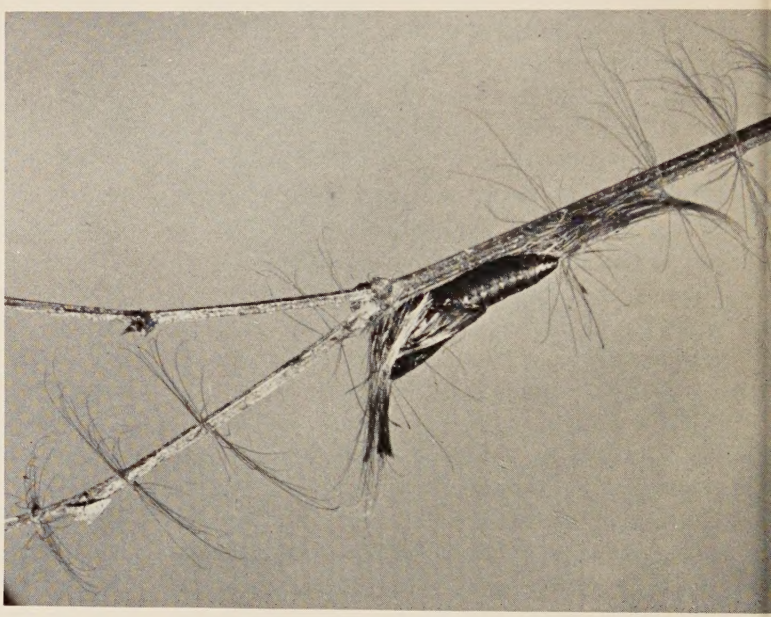
On the morning of the last day of its active existence, the larva chewed, swallowed and digested five inches of stem in two hours. In the afternoon it absorbed still more of the spiny chlorophyll, and then rested. At eight in the evening there was no change but at nine we discovered two symmetrical whorls of hairs surrounding the stem, well below the larva.

The caterpillar was now more than an inch in length, black, with two pale yellow side lines, while the fore and aft segments were decorated with a tuft of black, and numerous long, slender hairs, with curved tips. We now know it for the larva of a species of day-flying moth, with the euphonious family name of Euchromidae – the Well-colored Ones. To offset the dangers of life in bright sunshine many of these moths have been able to assume the colors and shapes of ill-tasting beetles, flies and wasps.

Here we have a normal egg, hatching into an ordinary caterpillar, feeding and molting as usual, but succeeded by the mystery of the two whorls of hairs. This creature had initiated something extra-ordinary, something beyond the mere spin-



This caterpillar of a day-flying euchromid moth is full-grown at a length of about an inch. It is now ready to become a chrysalid.
(Photographs by Rosemary Kenedy)



Before transforming, the caterpillar pulled out the long hairs and arranged them in a series of guarding whorls around the stem.

area on the stem, and through a lens I could see the spinneret busily at work, covering the stem with a coating of silk. Entangled was a multitude of minute, yellowish, viscid drops. Suddenly the larva reached around and the mass of long thoracic hairs was bent far forward. It seized a single hair, the mandibles slid down to the base, then up again a short distance. Here a firm grip was taken and with a strong pull the hair was uprooted. Thus a short extent of hair base projected beyond the mandibles.

The hair was pressed against the stem at the selected point and held in place by the sticky silk, while more adhesive wrapping was added. Another and another hair was pulled out and added to the whorl, until about twenty radii were in place. The first three or four were at right angles to one another, then the interspaces were filled in, the slightly overlapping bases forming a firm foundation. When the whorl was completed, a half dozen guy lines of silk held the whorl firmly attached to the stem above, thus counteracting any sagging due to gravity. In addition, the spokes themselves were bound together by a horizontal spiral of web, spider-fashion. The first whorl under observation was completed in fifteen minutes. Then the small creature rested.

The caterpillar erected its chevaux-de-frise in alternate fashion, first one whorl below, then

ning of a cocoon. The facts are apparent. The method and purpose are our objective.

As I have said, at nine in the evening the caterpillar was on the sedge stem, fronted with two whorls of hairs, and was busy weaving with head and forebody. All movement ceased in the glare of electric light. It worked only in darkness, so we made artificial night. To a flashlight we fitted a red filter, and from now on the caterpillar labored as in total darkness.

It crawled some distance up the stem and began a series of violent contortions. It rubbed its head sideways, back and forth, pressing down and massaging against its back the long hairs on its forebody. It twisted around laterally in a tight circle, squirming as if in torment.

Then it began to move its head about a definite

another above, gradually fencing itself on the stem into a slowly contracting area. When the final whorl was in place, there was left just sufficient room for the larva to weave a half open hammock in which to suspend itself in preparation for its next phase of existence. This openwork cocoon was inconspicuous; it might have been a bit of debris casually caught against the stem. To increase the camouflage, the caterpillar plucked forth the two black, tuftlike brushes of hairs and fastened them at head and foot of the chrysalid sarcophagus, as if a plume of winged seeds had lodged there.

The activities of Operation Whorls, as observed by us, began at nine in the evening. At three in the morning the complex work seemed finished, and three hours later, at six o'clock, the larva had made no further move. Throughout the night I had kept continuous watch, and whenever a new phase of activity became apparent I summoned my associates, to examine with the aid of the red filter and a hand lens the details and the progress of action and to verify every part of the performance.

The method of the complex defense mechanism was clear. The object seemed equally apparent; the whorls were obstructions to prevent any marauding enemy from approaching the chrysalid either from up or down the stem. Man uses an identical apparatus when he attaches a circle of tin halfway up a hawser fastening a vessel to the pier, to prevent the passage of rats up the rope.

Within a few hours the larva shed its skin for the last time and became a pupa, an immobile chrysalid. For ten days it lay in its hammock of silk and hair, outwardly motionless, while within, the surge of hormones worked unceasingly, changing a worm into a moth. On March 21st the delicate imago emerged, with transparent wings outlined in black scales, a thing of beauty and of the air, whose food was nectar, whose ultimate destiny was to deposit eggs on the stems of sedge, and whose man-made name is *Aethria carnicauda*. So the life cycle is complete.

What a comparison with the alter ego of this moth; the sexless, wormlike caterpillar, which, thinking only of the safety of its coming entombment, laboring in the blackness of the night, guarding against gravity, denuding its own body of structures and turning them into defense stockades, working cunningly with silk and glue, estimating distance and elevation, stress and strain, all with a definite purpose in mind! Such is the anthropomorphic point of view. The truth is that all this labyrinth of activity was initiated and completed at the urge of blind instinct, stimulated by omnipotent hormones, with no slightest aid of conscious realization or intelligence, all directed by an inherited unreasonable knowhow.

Out of the chrysalis comes the adult female — a delicate creature with transparent wings — whose function it is to feed on nectar and in due time to deposit eggs on stems of sedge.

Dasypeltis-
LITTLE SNAKE vs. BIG EGG

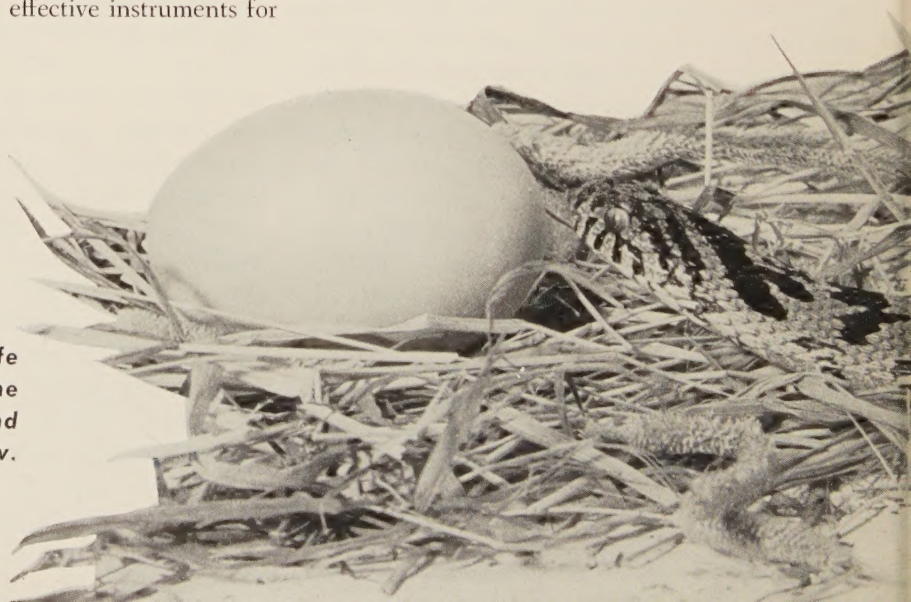
By CARL GANS

Research Associate, Carnegie Museum

MAN IS NOT THE ONLY CREATURE that relishes eggs. If our consumption of hen's eggs is not strictly "predation" on the hen, there are plenty of other animals whose relation to birds' eggs *is* that of predator. Red Squirrels, Rats, Opossums, Skunks, Crows and Bluejays are all fond of eggs, although they are merely a supplemental and seasonal food item. There is one animal, however, so completely specialized for egg-eating that it is almost incapable of eating anything else; it is *Dasypeltis,* the African Egg-eating Snake.

Offhand, it would seem that an egg is just about as awkward a food object as a snake could possibly attempt to eat. And so it is — for snakes, other than *Dasypeltis,* that eat eggs only occasionally. To watch a Blacksnake, for instance, struggling with an egg on a smooth floor is to be reminded of the old game of bobbing for apples. Time after time as the open jaws come down on the egg, it skids away. The sharp and backwardly curved teeth are effective instruments for holding soft-bodied prey and pulling it into the mouth by means of the independently activated sides of the upper and lower jaws, but they are of very little help when it comes to seizing a hard and slippery egg. It can usually be grasped only if it is pushed against some obstruction or perhaps a coil of the body. Even this requires considerable juggling and the size of the eggs which can be swallowed by this method is very definitely limited by the size of the snake's head.

It might reasonably be asked why snakes don't avoid all this trouble by merely breaking the egg and lapping up the contents. Unfortunately, a snake's tongue functions solely in relation to chemical perception and cannot be used for lapping. And egg fluid is generally much too viscous to be suitable for a snake to drink. The only practical method lies in swallowing the egg whole.



This photograph is nearly life size and dramatically shows the disparity between the snake and the egg it is about to swallow.

Normally when a snake swallows live prey, the food is extended and distorted into a long, thin bundle that is easy to swallow and to store in the stomach. Obviously a snake that crushes an egg in its mouth is going to get egg all over its face, and so an egg is usually swallowed whole. It remains intact in the stomach until the digestive juices have weakened the shell sufficiently for it to be broken easily, or it may be broken immediately after swallowing, by muscular contraction or by pressing the distended area of the body against some hard object.

Even after the contents of the egg have become available as food, the shell continues to pose difficulties to the snake. It takes up valuable space in the stomach until it is completely digested. Thus it would appear that only a fairly large snake can make a successful career of eating eggs by this method.

It is, then, rather surprising to find that *Dasypeltis* rarely reaches a length of three feet, and that even a large specimen capable of swallowing a goose egg has a body no larger than a man's middle finger.

It is the special equipment and the "know how" that makes all the difference. The Blacksnake, you might say, is a poorly equipped amateur; *Dasypeltis* is a superbly equipped professional egg-eater.

The most striking difference between *Dasypeltis* and other snakes is that *Dasypeltis* has almost no teeth – only a few tiny ones in the very rear of the lower jaw. Where other snakes have their backwardly-pointed teeth, the Egg-eating Snake has a series of thick folds of gum tissue, and the entire lining of the mouth is arranged in accordion-pleated folds. The folds of gum tissue act as little suction cups on the smooth egg surface, while the purpose of the pleated tissue is of course to allow the snake to open its mouth in an extremely wide, egg-encompassing gape without splitting itself "from ear to ear."

Another modification that allows *Dasypeltis* to open its jaws enormously wide concerns the scales on the head. In most snakes, the large scales of the lower jaw are usually divided into two groups, each fixed fairly closely to one or the other of the separately-moveable lower jaw bones. In *Dasypeltis* the scales are only loosely attached to the bones and thus the jawbones can move without unduly stretching the scales, which remain in a close bundle. Instead, the gum connecting the scales to the bone is arranged in loose folds – letting the jaws actually "leave" the scales during the gape.

To let them swing this way, the jaw bones are hinged differently from those of the more familiar snakes. Besides this there are tendons –veritable control cables – that automatically rotate the jawbones during the gape and always present their "strongest side," which also bears the suction folds, to the egg.

All this explains how *Dasypeltis* can manage to get an egg, even a very large egg, into its mouth. The specialization that takes over at that point and enables the snake to collapse the shell so neatly and efficiently is even more striking and is only now more or less completely understood.

The habit of *Dasypeltis* of feeding exclusively on eggs has been known for a long time – Lin-

naeus in 1754 described some of its peculiarities and noted that it had "Dentes nulli" — but it is only recently that we have learned what really happens when the egg is in the mouth.[1]

Behind the snake's mouth comes the esophagus, and then the stomach. In other animals the esophagus is merely the tube that connects the mouth and the stomach, and is quite devoid of any hard structures. Not so in *Dasypeltis;* its esophagus contains a series of bones that are actually modified projections of the spinal column. Some have runner-like keels, those of the next group are heavy and egg-shaped knobs, while the last half-dozen or so look like sharp,

[1] Gans, Carl. The Functional Morphology of the Egg-eating Adaptations in the Snake Genus *Dasypeltis.* Zoologica, 37 (18) : 209-244. 1952.

The egg is in the esophagus an throat muscles push it backwar The rear of the neck is bent so to bring the spines into pla

The jawbone seems to leave the scales of the chin region. Note the suction folds, visible along the edge of the protruding jaw.

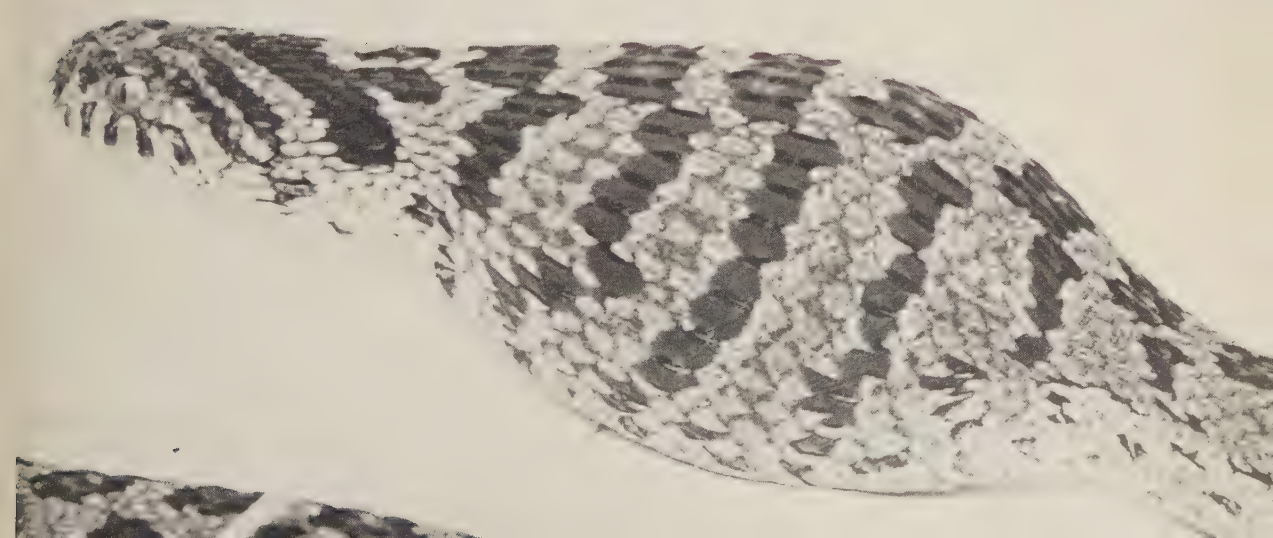
forward-pointing spines. These projections from the spinal column are technically called hypapophyses.

Back of the hypapophyses and just before the heart is encountered, the esophagus is pinched together to form what appears to be a valve between the gullet and the stomach.

It is all very peculiar and un-snake-like, and it is not to be wondered that earlier investigators were puzzled by these bony projections. Some suggested that they were really teeth, compensating for the almost total lack of teeth where snakes usually have them. Since teeth almost always have a covering of enamel, these "teeth" were said to be enamel-covered — even though they demonstrably are not. There was even more speculation about their function, and it has been variously reported that they are used to cut, bisect, or even saw the eggs after they have reached the snake's esophagus.

What really happens is much simpler. The egg moves down the esophagus, sliding down the runner-like keels. These not only ease its path,

The shell broken now, the egg is being emptied through the stomach valve. The neck is pinched in front, stopping forward flow.



The end of the process is the ejection of the shell, collapsed and in a neat package. It is easy for the snake to eject, and the contents have been squeezed down to the last drops.

but are also a remarkable adaptation for preventing the ribs and backbone from being bruised by the ungainly package. With the same efficiency the stomach valve will always stop a swallowed egg before it can slide back far enough to squeeze the snake's heart.

Before the egg reaches the end of the slide, the snake bends sharply so that the sharp spines jut out into the egg's path and can pierce it as it rams into them. Little force is required for this, because – as any cook knows – it is much easier to break an egg against the sharp edge of a pan than between one's fingers.

Ripped open on the spines, the egg now spills its contents through the valve into the stomach. A set of special muscles has closed the throat forward of the egg and there is no place for the contents to go except backward. The heavy knobs now come into play and squeeze down upon the shell. As the egg empties the same knobs roll up the sides of the shell so that it is packed into a compact bundle that can be regurgitated without trouble.

When the snake has squeezed out all the fluid, it closes a valve before the stomach, gives a few wiggles and out pops the shell from its mouth. The contortions accompanying this ejection are sometimes quite spectacular. The snake may jerk back and forth and even roll over. It generally gives the appearance of being in great trouble. No wonder a special valve was provided to keep it from upchucking its food at the same time!

Shell ejection is an extremely important feature of the economy of the snake. Since it can fill up with straight egg-fluid, and does not have to bother with the by-product of shell, it can gorge itself during the two African bird nesting seasons. The fat stored up at this time lasts the reptile as food during the remainder of the year.

Want to See a Florida Manatee?

By JOSEPH C. MOORE

Park Naturalist, Everglades National Park

AMONG THE RARE and interesting tropical animals which the Gulfstream climate of the southern tip of Florida supports, the sea cow or Manatee is not only the largest but one of the most mysterious in its way of life. We can almost count on the fingers of our two hands the known facts about the home life of our population of Manatees in south Florida. That some numbers of a marine mammal seven to twelve feet long can inhabit populated areas of the United States and keep their private lives virtually unknown to man is a preposterous fact in itself. But they do. Serenely dozing on the river bottom most of the day, some of our wild sea cows live in the Miami River in the very heart of downtown, metropolitan Miami. Thousands of people stream across ten or twelve bridges over this little river every day and hundreds of windows in residences, business places and hotels look down upon the narrow ribbon of its surface. In addition scores of pleasure boats daily follow the narrow channel between their docking spaces and the open freedom of the bay. But who sees the drowsing Manatee rise to breathe? Watchful boat captains, interested bridge attendants and the handful of people who dangle fishing lines from one of the bridges — these people sometimes do.

One reason why so few people see the Manatee is that the waters of the Miami River are almost never clear, and the animal is visible only when it is at the surface. In my observations of wild Manatees I have found that they rarely stay at the surface any longer than it takes to breathe, and they spend at least ten times that long below. Consequently, although you may watch the water surface sharply while walking across a bridge, the chances are probably worse than ten to one against seeing a Manatee, even if one is there. The rare person who crosses the bridge afoot and takes time to arrange his forearms comfortably on the rail to watch for half an hour or more is apt to have better luck.

When we have visitors who would like to see a Manatee, a convenient place to go is out Biscayne Boulevard to 55th Terrace. Where 55th Terrace dead-ends on the shore of Biscayne Bay about three blocks east of the boulevard in a pleasant residential district, you can sit comfortably in your car and watch for the sea cows to rise and blow. About fifty yards straight out in the water from the end of the street an 18-inch waste water pipe opens at the bottom This creates a considerable cloudiness or turbidity in the salt water and a usually noticeable "slick" on the surface. I suspect that the Manatees come to this place to drowse during the day because of some protection which the turbidity affords, perhaps protection from the sun. Usually someone is already waiting at the end of 55th Terrace to view the sea cows, or people fishing from the sea wall can report whether or not the sea cows are there. On one occasion when I visited this place, a kindergarten teacher had brought her class to see the Manatees. You may have to wait 12 or 15 minutes to be sure whether a sea cow will be seen, for very large ones may remain submerged that long.

What little we know about the sea cow's way of life is largely inferred from examinations of

Because of the strangeness of their form and habits, Manatees are well worth seeking out in Florida. These are young Amazon Manatees, distinguished by a strong white mark on belly.

the few specimens that have come into the hands of interested biologists, and from rare accounts of their behavior in an aquarium tank. This strange creature, shaped like a fat cigar, has but two limbs. These are small, short, paddle-shaped front flippers set very close to the neckless head. It possesses no hind limbs at all. The body tapers to a thin, flat, broadly rounded tail like a spatula. Up and down motion of the tail provides the power by which the sea cow swims. How different its locomotion from that of the four-legged land mammals from which it has descended! But as a relic of its ancestry, the sea cow still has hair (sparsely scattered bristles), and three finger nails on each of its little forelimbs.

Because of the rapid settlement and development of Florida in the past forty years, Manatees have needed protection, and Florida law has provided a $500 fine or three months' imprisonment for any person convicted of killing or capturing a Manatee in Florida waters without permit. This law may have been indifferently enforced occasionally, but it has unquestionably saved the Manatee from destruction by vandals and meat-hungry commercial fishermen.

A scattering of Manatees have survived in the labyrinth of waterways which masks the effluence of the Everglades on the southwest Florida coast. During the six years since this area became the Everglades National Park, the animals have found complete sanctuary enforced by vigilant park rangers. These remnant herds remain wary and wild because commercial fishermen who lived in this wilderness pursued and slaughtered them for meat. It may be several years before they relax enough to permit visitors to count upon seeing a Manatee during a one-day stay in the park. At the present time you can cruise for days through the maze of waterways among the jigsaw-puzzle islands and look in vain for a sea cow. With luck, however, you may see a series of up-boilings on the surface of the water, appearing successively farther away in a line. These are made by the powerful up-and-down motion of the swimming sea cow's tail. By watching and

following the line of up-boilings, you may be rewarded by seeing the creature put up its snout to breathe.

On winter mornings after especially cold nights, the big mammals congregate in shallow, turbid waters at several places in the Everglades National Park. Perhaps the combined body heat of closely grouped individuals and that of the sun helps them survive the cold. Manatees are really creatures of the tropics, and numbers have been killed by cold in Florida even as far south as Fort Myers. On cold mornings in the Everglades National Park we have several times encountered at least thirty-five, apparently banded together in small groups, in a mile of shallows along one meandering, mangrove-lined waterway.

The small population of sea cows in the St. Johns River in north Florida has a unique way of getting through the more severe cold in that part of the state. Upon the advent of a cold spell, the Manatees enter the warm water (70° to 72° F.) of a giant spring which flows into the St. Johns River. They remain in its crystal-clear waters during the cold snap or even for the entire cold part of the winter. This Manatee "hideout" is known as Blue Spring and is reached by a short road from Orange City. It is indeed unusual to find wild Florida Manatees in water so clear that you can see them serenely slumbering on the bottom ten feet below, for, as mentioned above, they usually inhabit waters which are turbid and dark. At Blue Springs it is common to see them rise periodically and dreamily to the surface to blow. Occasionally they bestir themselves to browse among the beds of wild celery on the bottom, although during cold spells they become rather torpid and seldom feed.

So — if a visitor to Florida wishes to enjoy a sight of this big tropical marine mammal — wild and free in its native haunts — these notes will provide him with several places to present his calling card.

SOMETHING NEW OUT OF AFRICA—

Double-tailed Earthworms

By G. E. GATES

From the Duckbilled Platypus of Australia to double-tailed earthworms from Africa seems a far cry, but the connection is there, and it came about by way of Florida and New York. The peculiar chain of events that eventually linked together these two animal curiosities — worlds apart both zoologically and geographically — started in 1946 with the decision of the Zoological Society to try to exhibit Duckbilled Platypuses. David Fleay, who developed a successful technique for keeping these rare and demanding creatures, found that one of their staple foods, in captivity at least, was earthworms. That was why a worm farm was started at the New York Zoological Park and it was through his operation of this farm that Curator Coates of the Aquarium brought to light the rare two-tailed worms.

In the Eighteenth Century Linnaeus, the first great classifier of animals and the inventor of the system of naming used by all scientists today, recognized only a single species of earthworm. But 300 years or more before his day, anglers knew there were several different kinds of angleworms

and could tell them apart. Today more than 2,000 species are listed.

If Curator Coates did not already know about the great variety of earthworms before he started to raise them for the Duckbilled Platypuses, the Platypuses themselves must have soon made him aware of it. To their finicky palates worms apparently have quite different tastes and some of the commoner types found around New York do not suit them very well.[1] In the search for more palatable worms, some strange kinds were turned up, and Curator Coates sent them to me for identification. Among these were at least two species never before found in the United States.

But the most amazing discovery came about through a contact that Mr. Coates established in 1952 with Mr. Tracy W. Baker of Lake Geneva, Florida. Mr. Baker, who runs a large worm farm catering especially to anglers – there are many of these located throughout the United States – had seen a magazine article about the Park's establishment and had written to Mr. Coates for information and advice. Along with his letter he sent a small box of worms, including several with double tails, for identification.

Mr. Baker's worms turned out to belong to the species *Eudrilus eugeniae*, and their presence in Florida is about as surprising as would be a Bushman child on our front doorstep. For the whole family of earthworms of which this species is a member is found naturally only in restricted portions of the African continent. We tried to find out how these worms got to Florida, but Mr. Baker did not know. A few cans of them had been inadvertently left behind in the icehouse at his fishing camp by a party of out-of-state fishermen. From these few hundred worms Mr. Baker had subsequently built up a great part of his stock of fishing worms. So we have no idea just where this African immigrant first became established in the United States or how long it has been here. Possibly the worms were carried from their original home in Africa in short stages and quite accidentally by man. One stage of the journey is certainly represented by the island of St. Helena, where the first specimens of *Eudrilus eugeniae* were secured. The worm was named after the Frigate *Eugenie* which made a round-the-world cruise in 1851-1853 in order to collect zoological specimens. At St. Helena, Dr. Kinberg, the ship's doctor, collected the first examples and later scientifically described them. For want of a better popular name we shall call them African Reds. This describes the color of the living worms and distinguishes the species from various American and European ones of a more or less similar color.

Three of the worms Mr. Baker sent to Curator Coates had the posterior part of their bodies duplicated. Their extra "tails" were well formed,

[1] Animal Kingdom, Vol. 54, No. 3, p. 95, 1951.

each containing a digestive canal and a nerve cord. One of the worms even showed the beginning of a third tail. Despite its diminutive size, this appendage, too, was equipped with a digestive tract. So far as is known, this specimen is unique; it is the only earthworm ever recorded as having three functional tails.

One of the most remarkable features of Mr. Baker's African Reds is the apparent frequency with which double-tailed individuals appear — perhaps in one out of every 500. This may not seem a high frequency, but two-tailed worms have never before to my knowledge been reported as occurring with any regularity. In all, about a dozen and a half abnormal specimens of the same type have been noted by biologists, but this was in six different countries, over a period of many years, and involved several different species.

All of these were more or less full grown, and double-tailed monsters of our present type have not been found inside the cocoons of earthworms. Biologists have therefore concluded that this abnormality is accidental rather than congenital. Two-tailed individuals have occasionally appeared in laboratory worms whose tails had been amputated. Instead of regenerating a single tail as they usually do, these individuals grew two. All of these, however, showed certain definite signs of the regenerative process, and such signs are entirely lacking in our double-tailed African Reds.

far as the author knows, this is the only earth-orm ever recorded with three functional tails. The rd tail is quite small, but it possesses a diges-e tract, as do the other tails in this specimen.

Moreover, Mr. Baker reports having seen small two-tailed worms which were apparently recently hatched. It looks as if the double-tailed African Reds were "born that way," but of course more study will be necessary to prove this.

There are other peculiarities about the African Reds that cry for solution. For instance, how do they grow?

People have wondered whether it is possible to estimate the age of an earthworm by counting its rings or segments, somewhat like the process of determining the age of trees or fishes by counting the growth rings of trunk or scale. Some biologists believe that when the little worm hatches out of the cocoon it is provided with as many segments as it will ever have. In that case growth must take place only by increase in size of already existing segments. Others believe that earthworms may grow by producing new segments after hatching. It might be possible to settle the question by counting segments of a lot of juveniles as they hatch out of the cocoon, keeping them in favorable conditions for several months and then counting the segments again. This apparently has not been tried, even for one single worm. Two biologists attacked the problem of growth in earthworms by mathematical procedures. Cocoons were collected from a manure pile. As the young hatched out segments were counted until 250 counts had been made — and that could not have been easy on tiny and delicate individuals. Then 250 worms, of larger size but not sexually mature, were collected from the same pile and their segments counted. Finally, segments of 250 sexually mature adults, from the same heap, were counted. Mathematical manipulation of all that data proved that as the worms grew older the number of segments grew smaller! That surprised the biologists but it might have been expected if they had stopped to think about all the moles, birds, boys and other animals that bite or break off tails of earthworms. In certain circumstances, a worm even breaks off a portion of its own tail, a sort of self-amputation that is called autotomy. So, the longer a worm lives, the more likely it is to have lost a portion of its tail. Amputees can hardly be expected to provide information of much value about normal growth. After all that difficult arithmetic, the problem of the earthworm's method of growth was no nearer a solution than before, and as far as the African Reds with their two tails are concerned, the growth problem is in some ways twice as mysterious.

Scientists have been allowed little time and almost no money for the study of earthworms, and there seems little hope for improvement in that respect in the future. If anglers, earthworm farmers and gardeners, however, will keep their eyes open and take advantage of such opportunities as chance provides, they may be able to help us add to the sum total of our knowledge of these interesting and economically important creatures in the same way that Mr. Baker has done.

Our Red Deer herd, led by a magnificent buck now nearly 14 years old, poses for a group picture. This herd was founded in 1900, a few weeks after the opening of the Zoological Park, by the gift of a pair of Red Deer from William Rockefeller. He gave us two more pairs in 1902 and the herd has been self-perpetuating except for the acquisition of the present buck in 1941. There are 20 animals in this picture, the entire herd. Periodically it is necessary to dispose of the excess animals and at the moment, besides the buck, we have only does and the 1953 fawns.

SUNBIRDS

Are, Indeed, "Splendid Natural Ornaments"

By ROBERT M. McCLUNG

Most of us have experienced the pleasure of watching a Ruby-throated Hummingbird hovering over a blossom in the garden. Its metallic throat glittering fiery red, for a moment it is suspended as if by invisible strings; the next instant, swift as a shooting star, it disappears.

Less familiar to us are the Hummingbirds' Old World counterparts, the Sunbirds of Asia and Africa. At the moment an excellent series of Sunbirds, as well as a few Hummingbirds, may be seen in the Jewel Room of our Large Bird House. Of all the world's birds, these two families, along with the Birds of Paradise, are probably the showiest and most beautiful, with their brilliant colors and unusual forms. Watching the faces of visitors and listening to their comments, the appeal of these birds to man's feeling for beauty cannot be denied.

Animals with bright colors — especially those with shimmering iridescent colors — have always excited man's admiration and fired his imagination. As a boy, I often stalked the big black Pipevine Swallowtails that fluttered around a neighbor's Dutchman's Pipe vine. I prized these butterflies especially because of their gleaming metallic colors. The forewings were a velvety blue-black, but the shimmering metallic hindwings changed from green to blue as they were viewed in different lights. I still remember boyhood hikes, when I would be rewarded by a brief glimpse of a Tiger Beetle sunning itself on a woodland path — a brilliant flash of green and gold in the sunlight. I seldom caught one of these prizes, for they were as fast and wary as they were beautiful.

Living creatures — especially birds and insects — which have iridescent or bright colors have often been collected and avidly exploited by man because of their beauty. Probably the most fa-

Apart from iridescence, some of the Sunbirds are otherwise rather gaudy — the Regal of the northeastern Belgian Congo has a red breast.

The Tacazze, especially notable because of the red-purple area of its back and its shimmering bronze throat, is one of the larger Sunbirds.

mous examples in this connection are the Birds of Paradise. The skins and plumes of these fabulous birds were yearly shipped by the thousands from the jungles of New Guinea to the fashion centers of Europe and America, until such trade was made illegal. However, the New Guinea natives still prize the skins and plumes of these birds, which they use for ceremonial adornment and head-dresses.

The great Morpho butterflies of South America are still taken and prized for their metallic blue wings, which are used by the natives to adorn themselves, and by civilized man in making costume jewelry and other articles of a decorative nature. Similarly, Hummingbirds are taken and valued in many areas of South America, as are Sunbirds in Africa and Asia.

Jardine, in "The Naturalist's Library," published in 1836, tells how the skins of one African species, the Red-breasted Sunbird, was exploited:

"This well known and elegant little bird seems to be particularly common in Senegal, from whence great numbers have been recently sent to Europe as articles of commerce. This unusual importation has arisen from the demand for Hummingbirds, and others of small size and rich plumage, in consequence of the fashion so prevalent with the fair sex, of decorating their hair with these splendid natural ornaments."

Apart from the metallic colors which are so prevalent in both Hummingbirds and Sunbirds, there are many other striking points of similarity between the two families, although they are not closely related at all. Both groups of birds are remarkable for their generally small size, their long, slender bills and their predilection for flowers as an important source of food. Like Hummingbirds, cock Sunbirds are often adorned with brilliant tufts of feathers, usually on the breast. Some Sunbirds have two very long graduated tail feathers, extending far beyond the rest of the tail, somewhat like the trains of various Hummingbirds. The casual observer in a foreign country might be hard put to know whether he

The Bronze Sunbird in a typical feeding posture. It perches as it drinks. Note its stout legs and how the feet grasp tightly.

With tiny, weak feet and legs, a Hummingbird hovers in mid-air in order to feed. This little creature is Boucard's Train Bearer.

had seen a Hummingbird or a Sunbird, except for the fact that Hummingbirds are exclusively New World birds, while the Sunbirds are found only in the Old World.

Despite their similarities, the differences between Sunbirds and Hummingbirds are obvious to the ornithologist and indicate that there is no near kinship between them. Hummingbirds are not perching birds. Their tiny, weak feet mark them as belonging to the order Apodiformes, which means, literally, "without feet." Their closest relatives are the Swifts. Hummingbirds have long, pointed wings which beat so rapidly — sixty or more times a second in some species — that they are practically invisible, this high speed enabling the Hummingbird to hover motionless in the air, to fly straight up or backward.

Sunbirds, on the other hand, have strong and well-developed feet, and belong to the great order of Passeriformes, or perching birds. Their nearest relatives are probably the Flower-peckers of Asia. The Sunbirds' wings are usually rounded. While

they are swift and accomplished fliers, the Sunbirds have never developed the ability to hover with quite the easy perfection of the Hummingbirds.

Newton, in his classic, "Dictionary of Birds," states that the Sunbirds got their names originally from natives of Asia, in tribute to their brilliant, shining plumage. Metallic hues of blue, green, violet, amethyst and bronze shimmer and glow in strong light, changing from one shade to another as the bird moves. Even more vivid are their non-metallic colors — reds and yellows.

Most non-metallic colors in feathers are caused by a chemical substance or pigment which absorbs some light rays and reflects others. In contrast to this type of "chemical coloration" are "structural colors." Sometimes the shade or color is due to the surface structure of the feather in conjunction with underlying pigments, but most metallic or iridescent colors are the result of structural features of the feather — very fine striations or ridges or thin films, which break up and reflect light rays much as do glass prisms.

In various parts of their range, Sunbirds are called by other descriptive but localized names. In parts of India they have been known, confusingly enough, as Hummingbirds. Captain G. E. Shelley states in his monograph of the Nectariniidae or Sunbirds,[1] that on Prince's Island off the west coast of Africa, the local species are called "Beshaflore," or "Flower-kissers," by the Portuguese. In Madagascar they are sometimes termed "Soumanga," or "Sugar-eaters." The *Arachnothera,* a genus of large, dull-colored Sunbirds native to Malaysia, are known as "Spider-hunters."

In his systematic revision of the group, Delacour recognized more than one hundred species of Sunbirds.[2] There are at least twice that many recognized subspecies. Sunbirds inhabit great areas of the Old World, from Madagascar through large portions of Africa, with one species being found in Palestine and Syria. To the eastward they are represented by numerous species in India, southeast Asia and the many islands of the southwest Pacific, including, among others, Sumatra, Java, Borneo, the Philippines, Celebes and New Guinea. One form is found in the northeast coastal areas of Australia. Living mainly in the tropics, Sunbirds are to be found from sea level up to the snow line on some mountain slopes.

Some forms are widespread in their range while others are astonishingly restricted. The Ruwenzori Double-collared Sunbird is said to be found only in a belt about 1,200 feet in width, from 10,000 to 11,200 feet of altitude on the slopes of Mount Ruwenzori in Uganda, while the Scarlet-tufted Malachite Sunbird is known only from the cold and bleak alpine zone of Mounts Kilimanjaro and Kenya, at elevations from 10,000 to 14,000 feet.

Most Sunbirds are non-migratory, in the customary sense. However, many make regular local movements, always being found when and where their favorite food plants are blooming. Some species in mountain areas will be found at high

Another one of the more brilliant Sunbirds is the Ruanda Double-collared, with an iridescent head and shoulders and a red breast.

1 "A Monograph of the Nectariniidae," 1880.
2 "A Revision of the Family Nectariniidae (Sunbirds)," Delacour, 1944.

altitudes during the summer flowering season, while in the winters they descend to the lowlands.

As Nectariniidae, the scientific name of the family, would indicate, the principal diet of most Sunbirds is nectar, which they gather from flowers. The long, slender and somewhat curved bill is an admirable instrument for probing, and from it the tongue may be thrust deep into the cup of a blossom to suck the nectar or pick up tiny insects. The tongue is usually flat for its basal one-third, evolving into a single tube which often becomes two tubes lying side by side near the front. In some species the tip of the tongue is minutely divided, almost brushlike.

While nectar forms a large portion of the Sunbird diet, tiny insects and spiders are also eaten. Some Sunbirds pierce the base of long, tubular flowers with the beak, after which the flicking tongue picks up nectar or insects.

The flight of Sunbirds is swift and often undulating, with rapid wingbeats. Hovering less casually than Hummingbirds, they often cling to stems, branches or tree trunks like titmice or warblers, searching crannies for food. When probing a flower, they usually perch on the stem, or flit nervously from one stand to another, fluttering their wings or flicking their tails.

Just as Hummingbirds are often familiar sights in our gardens, so are Sunbirds often seen around the gardens in many areas of Africa, India and the East Indies. A charming account of the behavior of the Amethyst-rumped Sunbird, a familiar visitor in the flower gardens of Ceylon, was written a century ago by a Mr. Layard:[3]

"My house in Colombo, was, as is usual in the East, surrounded by a verandah, upon which crept, in tropical profusion, several species of Passiflora; to the flowers of these came the various Nectariniidae for their morning and evening meals, rarely appearing in the heat of the day; they would fly into the verandah and seize a small spider from its web, or from the crevices of the wall. Then they would betake themselves to the trellis supporting the passion-flowers, or to the branches of a pomegranate close by, where they preened themselves and uttered a pleasant song. If two happened to come to the same flower, (and, from their number, this often occurred), a battle always ensued, which ended in the vanquished bird retreating from the spot with shrill piping cries, while the conqueror would take up his position upon the flower or stem and, swinging his little body to and fro till his coat of burnished steel gleamed and glittered in the sun, pour out his notes of triumph. All this time the wings were expanded and closed alternately."

A less pleasing observation concerning this same species is related by Shelley, who states that natives would capture them by using bird lime, and after plucking out their flight feathers so that they could not flutter, would tie them to sticks in rows, and carry them about for sale in the market places.

Sunbirds, like Hummingbirds, can be very pugnacious. During the breeding season, males of various species have been observed fighting each other furiously. A male bird may lay claim to a certain territory which he defends vigorously against all rivals, chasing away intruders. In courtship, the male may display before the female with quivering wings. The tufts of feathers so conspicuous in certain species are erect and prominently displayed during the courtship ritual.

[3] "Ann. Nat. Hist.," 1853. Second Series, XII, pp. 174.

The Golden-winged Sunbird from the highlands of Kenya and Uganda has an iridescent throat best described as gold-washed purple.

Many Sunbirds have short but often quite pleasing songs. The notes are usually rather shrill and metallic, but the total effect may be musical. The commonest notes are short, sharp "twits."

The cock bird usually has all the bright plumage, while the females for the most part are an inconspicuous olive-green or gray. In a very few forms the female may have some metallic coloring, too. In some species the male bird molts after the breeding season and takes on a dull eclipse plumage, much like that of the female. Young male birds resemble the adult female until they assume their first breeding plumage.

The nests, usually oval or pear-shaped, are commonly suspended from the underside of a large leaf or tip of a branch. The opening is at one side, often with a small roof or protective portico over it. Materials used in nest building are plant down, mosses and fine grasses. In several species, at least, dead leaves or other odds and ends are attached below the nest, often trailing a foot or more below.

Sunbirds will live quite well in captivity. We usually keep them alone or in pairs in individual cages, although Bronze Sunbirds have in the past been kept successfully in communal cages with other birds. They are given the same general diet as Hummingbirds receive — a mixture made up of honey, condensed milk and Mellin's food mixed with water, to which several drops of vitamin concentrate are added. In addition fruit is given. In the afternoon, a fresh mixture of water and honey is given to the birds. If small insects such as fruit flies can be supplied, all the better.

e Scarlet-tufted Malachite Sunbird is one of more striking species, found at elevations ove 10,000 feet in the highlands of Africa.

The first Sunbirds ever shown in the New York Zoological Park were a group of Indian Purple Sunbirds, purchased in Europe by Mr. Crandall in 1912. Through the years, individuals or several birds at a time were received, but our first considerable acquisition was a collection of 17 specimens captured by Charles Cordier in the Belgian Congo and received in June of 1949. Some of these birds are still living in our collections. Since 1912 we have exhibited 18 different forms, only two of which were Asiatic.

At the present time we have seven forms of Sunbirds, thanks in large part to the collector, Mr. John Seago, from whom we purchased nine specimens of five beautiful Kenya species early this year. When one looks at the brilliant coloring of the Double-collared Sunbird or the Malachite Sunbird, or the dazzling yellow and black of the Golden-winged Sunbird, it is easy to see why we call their exhibit hall the "Jewel Room."

Final Report on the Society's Own "Point Four" Program

By ROSS F. NIGRELLI

Chairman of "Point Four" Program

THE END OF 1953 also brought the formal ending of the "Point Four" Program initiated by the Zoological Society two years ago to aid European biologists in their scientific research. It is a "formal" ending only technically, because the actual results of this program should have no end — at the very least, the equipment furnished through it will go on being useful for years to come, and the feeling of good will engendered by it can never be measured in dollars and cents.

This feeling of appreciation and more-than-professional identity has not been one-sided, for the members of the Zoological Society's Committee appointed to distribute the "Point Four" funds, came to regard the work done by our European colleagues more highly than ever before and to consider it a privilege to be able to help them.

It was the job of the five of us — Miss Jocelyn Crane and Dr. William Beebe of the Department of Tropical Research, Director John Tee-Van, Curator of Reptiles James A. Oliver and myself — to weigh the applications for funds, deciding who should receive them and exactly how much. Naturally this was not an easy task, but it was a most satisfying one because of the opportunity it gave the Society to recognize and extend a helping hand to research projects of undoubted value.

As in 1952, the Society's Board of Trustees set aside $5,000 for use in 1953. Also as before, no single grant exceeded $400. In all, workers in twenty different institutions in nine European countries received aid. In cases where the cost of the required equipment exceeded the amount we felt we could allot, we did not hesitate to give a sum partially covering the expense, for with part of the necessary money actually in hand, the recipient was frequently able to obtain the rest from other sources.

The range of projects assisted was as various as it had been during the first year of operation, as may be seen by the following résumé of requests filled during 1953.

England

Bower Birds for comparative studies on their bower-building, courtship and other behavior.

Travelling expenses and trapping apparatus to observe insect migration in the Pyrenees.

Books and optical equipment for analyses of the vision of lower animals.

Snakes and lizards for determining the function of the fat bodies found in reptiles.

Microscope and a set of books necessary for research on the classification of beetles.

Nucleus of American books for a library specializing in field studies of birds.

Ireland

Low-power microscope to be used in an attempt to grow tapeworms in the laboratory outside of their hosts.

France

Paper needed for publishing one volume of a bibliography of spiders and their relatives.

Motion picture camera to photograph the behavior of mammals, birds and protozoans.

Assistance in the construction of special electro-chemical apparatus for studying substances essential to living tissues.

Belgium

Electrical meter to determine the acidity or alkalinity of aquatic habitats.

Germany

Sound filter necessary to analyze the noises produced by animals and the sounds to which they react.

Photographic material for studies on the behavior of insects.

Photographic supplies to be used in comparative behavior studies of various rodents.

Austria

Motion picture camera to record the activities of growing animals.

Netherlands

Books on birds of North and Central America and the West Indies to aid in studies on their taxonomy and geographical distribution.

Italy

Equipment, mostly glassware, for laboratory work on sea-squirts.

Microtome to section adrenal gland tissue for study under the microscope.

Chemicals essential to a study of the vital materials in the nucleus of the living cell.

Spain

Books and photographic equipment to aid in the study of Spanish shellfish such as crabs and spiny lobsters.

Publications in bio-mathematics needed for analyses of the process of sex determination, species formation, etc.

* * *

Obviously a program such as the Society's biological "Point Four" could go on forever, or at least as long as there are scientists working on problems of research. The past year has seen an improvement in European private and public funds available for research, however, and it was felt that the need for the kind of assistance we have been giving has appreciably lessened.

It's the "Fearsome Warracaba Tiger"

By WILLIAM BRIDGES

ONE MAN'S IMPLICIT BELIEFS are likely to be another man's superstitions, and this is never truer than in matters of popular beliefs about animals. The white races are particularly prone to smile at the credulities of "native peoples" in less materially advanced parts of the world – forgetting our own heritage of superstitions about black cats, "Ground Hog Day," Woolly Bear caterpillars, "hoop snakes" and the like.

Smile we must, though, at the redoubtable "Warracaba Tiger" of British Guiana, for at the moment we have one in the Zoological Park and at this distance from the forests of the Guianas it is hard to reconcile this peaceable wild dog with its legend. The Warracaba Tiger, as we know it, is simply *Icticyon venaticus,* otherwise called the Bush Dog. Our young male is certainly not tame, but it is by no means intractably fierce and it has no hesitation about trotting over to the front of its compartment when it is called or stopping to sniff a hand held out to it.

It may be that even in its native country the dread of the Warracaba Tiger is dying out. Nicholas Guppy, nephew of the Guiana naturalist, P. L. Guppy, and himself a botanist who has recently spent considerable time in British Guiana, reports an impression that while the older Indians believe that Warracaba Tiger packs still exist in remote mountain districts, the

younger men – with, perhaps, more contact with white people and less familiarity with the wild areas – are willing to accept the white man's identification of the "Tiger" with the Bush Dog.

More than forty years ago when Lee S. Crandall, now General Curator Emeritus, was working in British Guiana, he heard many stories of the Warracaba Tiger, although he met no Indian who professed to have seen the animal.

"The way it usually happened," he recalls, "an Indian would be in his hammock some night and he'd hear a pack of Bush Dogs in the distance. They may yelp or bark as they run – I don't know; I never saw a pack. At any rate, as far as the Indian was concerned, it was a pack of Warracaba Tigers and he wasn't going to investigate any further. Even in daylight he had a tendency to get away fast if he heard those same sounds. That could be why you never found an Indian who had actually seen Warracaba Tigers.

Our "Warracaba Tiger," better known as a Bush Dog, is not exactly tame but it is interested in visitors and sometimes wags its tail.

"They all knew the Bush Dog, for you run across one occasionally. They simply didn't connect it with the sounds they heard in the night. At least that's a good working theory."

White men, on the other hand, being more skeptical by nature and never having encountered any animal except the Bush Dog that fitted the Indian description of the Warracaba Tiger, settled it in their own minds that the tiger and the dog are one and the same. That is the general belief of naturalists today.

Many of the older books about life in British Guiana recount stories of the Warracaba Tiger. Henry Kirke's "Twenty-five Years in British Guiana," published in 1898, has one of the fullest accounts, since it incorporates a quotation from

an earlier author. Here is what Kirke says about the animal:

> There is a mysterious beast in the forest called by the native Indians the "waracabra tiger." All travellers in the forests of Guiana speak of this dreaded animal, but strange to say, none of them appear to have seen it. The Indians profess the greatest terror of it. It is said to hunt in packs (which tigers never do), and when its howls awake the echoes of the forest, the Indians at once take to their canoes and wood skins as the only safe refuge from its ravages. Mr. C. Barrington Brown, in his book, "Canoe and Camp Life in British Guiana," says that one day, when he was on the Curiebrong River, a branch of the Massaruni, he had a curious encounter with these animals. To quote his words: "I was busy writing letters when my attention was attracted by our two dogs, which had been tied up, barking furiously, followed by a great stir in the camp. Then some voices proclaimed loudly, 'The tigers are coming!' and one man called to me to come down as quickly as possible to the boats and bring my gun.
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> "Thinking at the moment that a couple of jaguars had been heard close by, I seized my gun and made a rush down the slope, eager to get a shot at one, when, to my surprise, I found the beach deserted. Where some twenty Indians had been camped, there was now not even a hammock left; all had suddenly and completely vanished, leaving only a stray hammock-pole and the smouldering fires. My men had all taken to the boat, and had it afloat, with the bow barely grounded, in readiness to shove off. They greeted me with cries of, 'Quick, quick! the waracabra tigers are coming!' There was quite a flutter of relief amongst them when the boat was pushed off into mid-stream, when they all began to talk excitedly over our escape. The dogs still gave tongue, and were even more excited than the men, the hair on their backs standing erect as they sniffed the air in the direction of the camp. I eagerly inquired what were waracabra tigers, and was hastily informed they were small but exceedingly ferocious tigers; that they hunted in packs, and were not frightened by camp fires or anything except the barking of dogs. We crossed the river, and as we stopped a shrill scream rent the air from the opposite side of the river, not two hundred yards above our camp, and waking up echoes in the forest, died away as suddenly as it rose. This was answered by another cry, coming from the depths of the forest, the intervals being filled up by low growls and trumpeting sounds, which smote most disagreeably on the ear. Gradually the cries became fainter and fainter, as the band retired from our vicinity, till they utterly died away. Seeing nothing of them, and hearing their diabolical screams, I pictured them in my mind as a withering scourge sweeping through the forest. The call of these animals resembles that of the waracabra or trumpet bird (*Psophia crepitans*), hence they have obtained the name of waracabra tigers. The Accawoio Indians call them y'agamisheri, and say that they vary in size as well as in colour. As many as a hundred have been seen in a pack."
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> These strange animals cannot be felidae, as they are never known to hunt in packs. Their screams recall recollections of the packs of jackals in India; so I suspect they must be animals of the jackal or wolf tribe, especially as they are said to live in the mountains, and only come to the low land in the dry season, and when pressed by hunger.

Brown's account, quoted by Kirke above, is cited in Everard F. im Thurn's "Among the Indians of Guiana," published in 1883. Thurn adds a few embellishments to general knowledge, however; he had heard the name "Warracaba Tiger" (or Waracabra) attributed to the resemblance between the cry of the "tiger" and the call of the Warracaba Bird, and also to the resemblance of the color of the mammal to the breast feathers of the bird. Again, he had been told that the name comes from the fact that the "tigers" prey on the bird. Thurn professed to have found three persons who had actually seen Warracaba Tigers, but he admitted that one of his informants, a Portuguese policeman who had been chased up a tree by a "flock" of the animals, went on to build his story up in an obviously exaggerated form.

Thurn's own suggestions was that "possibly all the stories may be founded on the fact that families of pumas (*F. concolor*), consisting of parents and cubs, occasionally move about together."

Despite the reports of various writers that the Warracaba Tiger is so named because of the resemblance of its cry to that of the Warracaba Bird, or Trumpeter, it takes a good deal of imagination to connect the two. The "Tiger" is supposed to make a loud and fearsome sound, a "diabolical scream," whereas the call of the Trumpeter – at least those specimens that we have exhibited – is low and not at all intimidating. It can be roughly put into words as a descending series of booms followed by a rumbling roll. The only sound we have heard our Bush Dog make is a kind of whistling whine.

There are many references to the "tiger" in the literature about British Guiana, but one final quotation would seem to settle the matter. It is from the Thirteenth Annual Report of the Bureau of American Ethnology of the Smithsonian Institution, 1908-1909, and specifically from an article, "An Inquiry Into the Animism and Folklore of the Guiana Indians," by Dr. Walter E. Roth, formerly Commissioner of the Pomeroon District of British Guiana.

"I am afraid," he wrote, "that the existence of a Warracaba tiger, like many another quaint conceit, must be consigned to the oblivion of superstition."

* * *

Our "Warracaba Tiger" was captured in the interior of British Guiana by Charles Cordier on his 1953 collecting trip to the Guianas. Crossing a river one day in a small outboard motor boat, he encountered three of the dogs swimming. They were netted and hauled into the boat, but only after one was injured by being struck by the propeller. At the Cordiers' base camp, Mrs. Cordier confined them in what she considered an extremely heavy and safe cage, made of thick boards and wire netting. Nevertheless the male managed to chew his way out and to escape. He was recaptured after he returned to the vicinity of the female, which had not escaped. Later Mr. Cordier caught still another specimen.

We have exhibited *Icticyon venaticus* only once before, in 1931, but some ten years before that time the species had been exhibited in Amsterdam Zoo, and had bred there. It is still a rare animal in zoological collections, and much remains to be learned about its life in the wild.

News from the Conservation Foundation

Mid-Century Conference Held

President Eisenhower addressed the opening meeting of the Mid-century Conference on Resources for the Future, held in Washington in December. Various officers of the Conservation Foundation took active parts in the planning of this conference: Mr. Osborn as a member of the Planning Committee, Mr. Ordway as Counsel, Mr. Snider as Assistant to the Chairman for the Panel on Research and Mr. Bergen as rapporteur for the Panel on Water Supply. Enrollment of businessmen, educators, technicians and civic leaders was 50% greater than anticipated, and totaled 1,460 individuals. While the proceedings indicated that there was difference of opinion as to whether the increasing demands of our population and economic growth in the next 25 years can be met by new technological discoveries and the development of substitutes, there was general agreement that conservation and the use of our natural resources is one of the most crucial problems that faces our nation.

Natural Resources Council

Samuel H. Ordway, Vice-president of the Foundation, has recently been elected Chairman of the Natural Resources Council of America, a group of representatives of more than thirty conservation organizations which serves as a clearing house of information and policy guidance. The Council does not take political action.

Statistical Data on Jamaica Population

George W. P. Roberts, one of the leading demographic statisticians of the British West Indies, on leave from the British West Indies Development and Welfare Organization in Barbados, is now engaged at the office of the Conservation Foundation in completing statistical studies which are part of the Foundation's research project on the relationship of population trends and resources on the island of Jamaica. This project should be completed during 1954.

New Books by Staff Officers

Mr. Osborn's new book, "The Limits of the Earth," is now selling ahead of sales made during the comparable period by his previous book, "Our Plundered Planet."

"Resources and The American Dream," by Samuel H. Ordway, was published on October 23. It challenges several existing concepts regarding American materialism, and has been the subject of a series of radio discussions.

Boy Scouts in Conservation

During the past two years officers of the Conservation Foundation have held many conferences with officers of the Boy Scouts of America to help develop a major conservation program for the five million men and boys engaged in Scouting. This year, on the recommendation and at the request of President Eisenhower, the Boy Scouts have launched a major program entitled "The Conservation Good Turn" which will lead all levels of the Scout organization and individual Scouts into intensive study of local conservation problems and local action to publicize the problem and improve the use of resources in every community. Fairfield Osborn is a member of the Scouts National Conservation Advisory Committee and of the Committee on Activities and Special Events for 1954.

Recent and Forthcoming Books

These three books, sponsored by the Conservation Foundation, have either just appeared or will soon be published:

"Wildlife in Alaska – An Ecological Reconnaissance," by A. Starker Leopold and F. Fraser Darling.

"The Flood Control Controversy – Big Dams, Little Dams, Land Management." An analysis of upstream and downstream programs, by Luna B. Leopold and Thomas Maddock, Jr.

"Fresh Water from the Ocean – for Cities and Farms." A technical study of the feasibility of converting salt-water to fresh on a large scale, by C. E. Ellis.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Praise for Beebe-Crane Film

Several years ago Dr. William Beebe and Miss Jocelyn Crane, while working at the Department of Tropical Research laboratory in Venezuela, put together a 16 mm. motion picture, in color, called "Curioseando en las Selvas Venezolanas." Recently Dr. Beebe has been informed by Sr. Guillermo Zuloaga, vice-president of the Creole Petroleum Corporation, that the picture has been seen by approximately half a million persons and that it is still in demand in Venezuela. The Venezuelan Foreign Office has distributed the picture through its embassies. "The Beebe and Crane film has easily been the most successful movie venture that we have ever undertaken," Sr. Zuloaga wrote Dr. Beebe. – W. Bridges

"People and Animals"

An informative and thought-provoking article by President Osborn appeared in the January issue of *The Atlantic Monthly*. Entitled "People and Animals," it recounts anecdotally some of the things we have been learning about animals as a result of years of zoo-keeping, and cites inci-

A 13-foot Anaconda in our reptile collection enjoys special privileges. At cage-cleaning time each day, Keeper Spencook gives it a few minutes' liberty in the corridor behind the cages. The snake is now so accustomed to its outing that on occasions when the keeper does not allow it to go outside, he has a good deal of trouble keeping it in the cage.

dents of the interactions between the staff and the animals, between visitors and the animals. "A zoo is the best kind of antidote to the over-mechanization of these modern days," Mr. Osborn concludes. "To many people it is more than that. To them the observation and study of animal life in its myriad forms is a lasting inspirational experience — a revelation of movement, color, and sound, the end results of timeless processes of adaptation and evolution." — W. Bridges

Duck-bills Are on Exhibition

Our Duck-billed Platypuses, Cecil and Penelope, were placed on exhibition on Saturday, January 9, in their new Platypusary in the Heads & Horns Museum. The animals will alternate exhibition days, from 2 to 3 o'clock each afternoon. Admission is 10 cents plus tax, but Members of the Zoological Society will be admitted without charge. — W. Bridges

"Unseen Life in New York"

Less in the nature of a book review than of a report to our Members, this is an announcement of the publication of Dr. William Beebe's latest book, "Unseen Life in New York." Parts of the book appeared a few years ago in Animal Kingdom when Dr. Beebe was writing about "The Broadway Mastodon," "The Sabre-toothed Tiger," "The Manhattan Grubber," and other now extinct creatures that once roamed the precincts of the Bronx Zoo.

In his new book the Director Emeritus of our Department of Tropical Research has assembled a series of essays, or articles, on the animal life of the New York City area in prehistoric times, as recorded in fossils; of vanished life of later days that is now remembered in books; and then the still-existing and surprisingly varied life of the present time that can only be seen by means of a microscope, or patient investigation — or by the imagination of a William Beebe.

The apt and amusing illustrations of the book are by Donald T. Carlisle. It was published by Duell, Sloan & Pearce — Little, Brown, and the price is $4.00. — W. Bridges

Zoological Park Miscellany

In the Aquatic Bird House is a new Frigate Bird from Florida, the first specimen we have

exhibited since 1946. Unable to take off in flight from a level surface, it perches most of the time on a low stone in the Flight Cage . . . A three-year-old female Wolverine and a year-old male have been received from Denmark and will be introduced to our current exhibit of two females . . . Black-tailed Marmoset twins were born in the Animal Nursery early in January . . . A baby Gray Phalanger emerged from the maternal pouch on January 4 and at the end of the month was still spending a good deal of time in the pouch, although its body had grown to a length of about six inches and its tail to the same length . . . The reptile collection, scattered in basements all over the Zoological Park since remodelling of the interior began last summer, is gradually returning to the Reptile House as reconstruction nears its end. The building will not be ready for visitors before the spring, however. There will be a special re-opening for members of the Zoological Society.—W. Bridges

Another Longevity Record

When Karl Plath, now Curator of Birds at the Chicago Zoological Park, was a private aviculturist, he received three Black-necked Stilts, *Himantopus h. mexicanus,* from Utah. These birds had been hatched in the spring of 1934 and carefully hand-reared. They were received by Mr. Plath on August 19, 1934. After enjoying the "Three Graces" for some weeks, he reduced the triumvirate to two by graciously sending one to us in exchange. The bird arrived here on October 30, 1934. Stilts, like Avocets, are among the most delicate of shore-birds and we did not expect too much of our beauty. However, as the years rolled on, our opinion of the viability of stilts changed with them. When this lovely and exceptional individual died on December 14, 1953, she had established a record with us of 19 years, one month and fourteen days, a remarkable span for the species and far in excess of any other that is known to us.—L.S.C.

PUBLICATIONS OF INTEREST

REPTILES AND AMPHIBIANS — A Guide to Familiar American Species. By Herbert S. Zim and Hobart M. Smith. 157 pp., distribution maps and numerous colored illustrations by James Gordon Irving. A Golden Nature Guide, Simon & Shuster, New York. $1.50.

The authors and the artist of this little book have produced an attractive introduction to the common amphibians and reptiles of the United States. It provides an abbreviated general summary of information on the characters and nature of these animals, followed by short accounts of individual species or groups of species. The latter are illustrated in color and their distribution in the United States is outlined on an inset map.

This guide will doubtless serve as the starting point for many budding herpetologists and amateur naturalists interested in learning about amphibians and reptiles. For this purpose the book is admirably conceived and well organized, but unhappily its execution is sometimes faulty. It would be but carping to base this statement on minor flaws in typography. However, there are several seriously misleading statements in the book and Mr. Irving's illustrations occasionally vary far from actuality. As was pointed out in the March-April 1953 issue of *Animal Kingdom* in a review of Zim's book, "Alligators and Crocodiles," it is incorrect to say that the body temperature of reptiles "remains about that of the surrounding air." It is ecologically naive and scientifically inaccurate to state that amphibians and reptiles "should be protected for our own enjoyment and for the future. . . . If they should all disappear, it would not make much difference one way or the other." On page 12 the statement is made that "Neither reptiles nor amphibians are intelligent enough to make good pets. . . ," but on page 17 appears the remark that "Some reptiles make interesting and unusual pets." To further contradict this first statement the authors state in the separate species accounts at least eight times that particular forms make "fine," "good" or "excellent" pets. Despite these and a few other slips, "Reptiles and Amphibians" will prove a useful little guide to our more familiar species.

—J. A. Oliver

WILDLIFE IN ALASKA. An Ecological Reconnaissance. By A. Starker Leopold and F. Fraser Darling. 129 pp., 6 text-figs., 22 photographs. The Ronald Press Co., New York, 1953. $2.75.

The ecological reconnaissance of Alaska treated in this new book was sponsored by the New York Zoological Society and the Conservation Foundation. President Fairfield Osborn's "Foreword" will serve as a pertinent announcement:

"This field study concerns the great horned animals of Alaska and their environment in one of the last frontier lands of the world. A work of keen observation and scholarship, it analyzes the ever changing relationships between man, these grazing animals, and their habitat. It stresses the importance of wild life management in a territory whose invaluable assets are the living natural resources on the land and in the adjacent waters.

"With the development of Alaska's economy in mind, the authors recommend a broader and a more coordinated approach to the management of these resources. The adoption of such recommendations is particularly important in a region where the resources of the land, despite some early despoliation, are still largely intact and remain, with a few exceptions, the property of all the people of the United States. The situation presents a unique opportunity to initiate a comprehensive conservation program before the territory is subjected to haphazard development."

SIAMESE CAT BOOK. By Vera M. Nelson. Illus. by 27 photographs in black and white and 5 line drawings. Pages 103 + viii. All-Pets Books, Inc., Fond du Lac, Wisconsin, 1953. Price $2.

Both the owner of a pet and the more ambitious breeder and exhibitor of Siamese will find Mrs. Nelson's book useful and instructive. Sensibly and soundly written, it will serve to replace much prevalent nonsense concerning this attractive breed with realistic information. Pregnancy, birth of kittens, rearing and grooming for the final championship, are expertly treated in helpful detail and the curious, un-cat-like behavior of the Siamese cat has not been neglected. – L.S.C.

CARE AND BREEDING OF BUDGIES. By Cyril H. Rogers. Forty illus. in black and white, from drawings and photographs. 93 pages. Dover Publications, Inc., New York, 1953. Cloth $1.75; paper, $.65.

Since the recent relaxation of prohibitive regulations in many areas of this country, the attractive little Budgerigar or Shell Parrakeet has achieved immense popularity as a house pet. It is now bred in captivity in large numbers and the young bird, taken from the nest and finished off by hand, is not only charmingly tame but may learn to repeat words and phrases in a tiny, elfin voice. Mr. Rogers' book gives excellent advice on selecting, correct handling and feeding, teaching to talk and breeding. Under the latter heading, the complicated color patterns and their genetic relationships are fully explained. The drawings of Lloyd Sandford, Staff Artist of the Zoological Park, add much to the general attractiveness of a book which information centers and pet owners alike will find most useful. – L.S.C.

SONGBIRDS IN YOUR GARDEN. By John K. Terres. Introduction by Edwin Way Teale. Pp. 274 + xiv. Frontispiece in color, numerous line drawings. Thomas Y. Crowell Co., New York, 1953. $3.95.

As Managing Editor of the *Audubon Magazine*, Mr. Terres is in an excellent position for keeping abreast of the latest developments in methods of attracting birds. In a field in which there is no paucity of literature, this newest volume will immediately find a place, for changing conditions must always be met with modern methods. Feeding, nest boxes, planting and other related subjects are covered thoroughly and in satisfactory detail.–L.S.C.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1953)

Founder

Sir Edward Hallstrom

Fellow

James W. Atz

Life

Mrs. Robert C. Stanley

Contributing

Mrs. Rita Allen
Walter C. Baker
Miss Grace E. Bourne
Harold E. Bruce
Meyer Camhi
Christopher T. Chenery
Mrs. Edward P. Curtis
Howard M. Erskine
Miss Frances Ferguson
Edward R. Gay
Albert H. Gregg
Mrs. S. B. Grimson
Mrs. Richard Heimann
Herman Jaffe
Mrs. B. B. Jennings
Carl T. Keller
Henry F. J. Knobloch
John S. Magrane
Mrs. Richard A. North
Carleton H. Palmer
Dr. Felix A. Pappalardi
Wm. P. T. Preston
Mrs. G. B. Reisweber
David L. Richardson
Dr. A. Schenker
Master Marc R. Shapiro
Ronald Tree
Miss Winifred S. Ward

Annual

Mrs. Donald B. Aldrich
Clark Andrews
Hugh H. Babcock
Franco A. Baronio
Mrs. Blanche Barreto
Mrs. Theodore Benno
Miss Pearl B. Bolie
Carl Andrew Brodman
James L. Buckley
Miss Maedalena Burckardt
Donald F. Bush
Mrs. Charles W. Caldwell
Ingram S. Carner
William R. Chandler
Mrs. Shirley A. Chidsey
Mrs. Charles T. Church
Mrs. Randolph P. Compton
Paul Cushman
Jay N. Darling
Mrs. Caroline C. Davis
Mrs. William K. Dick
Miss Ruth Draper
Mrs. Janice Edwards
Miss Sara Fischer
Mrs. Leafie Freda
Bruce Gilley
Morrill Goddard
Howard Greenley
Dr. Charles C. Hall
Dr. Robert H. Halsey
Gertrude F. Harrison
Fraser M. Horn
Miss Lillian Iverson
Miss Margaret I. Jensen
Dr. George H. H. Knight
Ronald W. Kranebell
Mrs. Elsa Kurzbauer
Louis J. Laux
John W. Leahy
Clarence Lewis
Lawrence W. Lowman
Julius Liebman
Dr. Samuel Nelson Lipsett
Edward S. Litchfield
Miss Margaret P. Mendel
John R. Muma
Miss Eleanor Murray
Mrs. William S. Paley
Miss Chara Ann Phillips
Mrs. Harvey Picker
Mrs. Bernice Platt
Hugh Porter
Mrs. Marshall Prentiss
Mrs. Emerson B. Quaile
Mrs. John S. Reaves
Mrs. Nicholas G. Rutgers
Mitchel Samuels
Robert Schreiber
S. Spencer Scott
Mrs. Virginia Sheward
Morton Silberman
Mrs. June Havoc Spier
Mrs. A. V. Stout
Norman M. Thomas
Mrs. Nion Tucker
Mrs. Sally Weinstein
John Whitney
Mrs. Arnold Whitridge
Mrs. Douglas Williams